Using artificial intelligence in image-based process monitoring

Conventional methods of image processing must be precisely tailored to a specific application when used in the field of process monitoring. They can, therefore, easily become imprecise and unreliable due to normal scattering of image properties. To overcome these disadvantages, Fraunhofer ILT is taking a new approach to image-based process monitoring.

Semantic segmentation in process monitoring

Ideal for image classification tasks, artificial intelligence (AI) methods are applied in many areas of image processing. For image-based process monitoring, deep neural networks are used for the semantic segmentation of process images. Here, the deep neural network assigns each pixel of the input image to a semantic region relevant for the process. For example, all pixels that represent a melt pool are assigned to one region, while those of the filler wire, the weld seam, etc. are each assigned to another, separate region. At the same time, the information from this image segmentation opens up many options for process monitoring.

Quantitative variables from the process

On the one hand, quantitative variables such as the length and width of the melt pool or the position of the filler wire can be determined automatically and, in particular, simultaneously. This makes it possible to automatically document the process and to correlate it with statements on process quality. On the other hand, semantic segmentation also allows in-situ process control. For this, the neural network and the higher-level data processing must be able to process the process images in "real time." The artificial neural network of the system developed by Fraunhofer ILT can process more than 100 images per second without any special hardware requirements.

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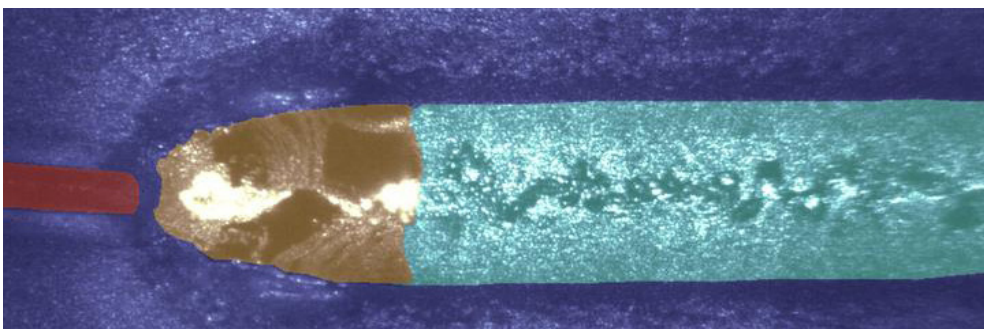
1 Camera image of a laser soldering process. 2 Segmentation of the camera image.